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10 CFR 50.73

W3F1-2020-0012

April 8, 2020

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Subject: Licensee Event Report (LER) 2019-005-01
Automatic Reactor SCRAM due to Steam Generator #1 High Level Resulting from a Main Turbine Trip and Subsequent Reactor Power Cutback due to Failed Diode Modules within the Main Exciter

Waterford Steam Electric Station, Unit 3 (Waterford 3)
NRC Docket No. 50-382
Renewed Facility Operating License No. NPF-38

In accordance with 10 CFR 50.73, Entergy is hereby submitting supplemental LER 2019-005-01 for an event that occurred on May 16, 2019.

This letter contains no new regulatory commitments.

If you have any questions or require additional information, please contact the Regulatory Assurance Manager, Paul Wood, at (504) 464-3786.

Respectfully,

Paul Wood

Paul Wood

PW/jb

Enclosure: Waterford 3 Licensee Event Report 2019-005-01

cc: NRC Region IV Regional Administrator
NRC Senior Resident Inspector – Waterford Steam Electric Station, Unit 3
NRR Project Manager

ENCLOSURE

W3F1-2020-0012

Entergy Operations, Inc.

Waterford 3 Licensee Event Report 2019-005-01

(4 pages)

NRC FORM 366 (04-2020)	U.S. NUCLEAR REGULATORY COMMISSION	APPROVED BY OMB: NO. 3150-0104	EXPIRES: 04/30/2020

LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc/gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
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4. TITLE
Automatic Reactor Scram due to Steam Generator #1 High Level Resulting from a Main Turbine Trip and Subsequent Reactor Power Cutback due to Failed Diode Modules within the Main Exciter

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									FACILITY NAME	DOCKET NUMBER
05	16	2019	2019 -	005	- 01	04	08	2020		

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
1	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
10. POWER LEVEL	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
100	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(i)
	☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(ii)
		☐ 50.73(a)(2)(i)(C)	☐ OTHER	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT	TELEPHONE NUMBER *(Include Area Code)*
Paul Wood - Manager, Regulatory Assurance	(504) 464-3786

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
D	TL	EXC	W120	Yes					

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO				

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On May 16, 2019, at 1348, Waterford 3 experienced an automatic reactor trip due to Steam Generator 1 high level, which occurred following a main turbine trip and reactor power cutback. The automatic reactor trip due to Steam Generator 1 high level was caused by feedwater control shifting to manual during reactor power cutback due to a deviation between Steam Generator level channels. Because feedwater control was in manual, the system could not lower feed water flow in response to rising Steam Generator level. Main Feedwater Isolation Valves #1 and #2 closed on high Steam Generator levels. Emergency Feedwater automatically actuated as expected for Steam Generator #1 and #2. Main Feedwater was restored to both Steam Generators by 1629.

The main turbine trip was caused by a loss of excitation within the main generator field. The cause of the loss of excitation was determined to be a short between 2 diode modules within the rotating rectifier circuit of the Main Exciter. The Main Exciter was mechanically disassembled and the failed fuses and diode modules in the rotating rectifier wheel were replaced. The entire rotating rectifier assembly was refurbished and/or repaired as appropriate. The exciter control system was fully calibrated prior to startup.

All required safety-related equipment responded as expected during this event.

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NARRATIVE

EVENT DESCRIPTION

A. Plant Status

At the time of this event Waterford 3 was operating at 100% reactor power. No structures, systems or components were out of service that contributed to this event.

B. Event Chronology

On 05/16/2019 at 1344, Waterford 3 Plant Monitoring Computer (PMC) indicated that the GEN LOC 86 G1/G2 RLY (GOB, PMC point D58715) tripped followed by the 86G1 MN GEN FLD FAIL RLY 40S (PMC point D58703) tripping 0.03 seconds later. These relays actuate automatically, indicating a Main Generator loss of field. There was no work being performed on the Main Generator or Exciter at this time.

At 1345, reactor power cutback occurred due to the main turbine trip. This resulted in the rapid lowering of the Steam Generator (SG) levels due to shrink. Following the reactor power cutback a deviation greater than 7% occurred between the two level measurement channels on both Steam Generator #1 and #2. In response to this deviation, Feed Water Control forced the controllers for the Startup Feed Reg Valves 1 & 2, Main Feed Reg Valves 1 & 2, and both Feed Pumps to manual. Because feedwater control was in manual, the system could not lower feed water flow in response to rising Steam Generator level.

At 1348, reactor trip on Steam Generator #1 high level. Main feed isolation valves 1 and 2 closed on high level isolate. The automatic actuation of the Reactor Protection System (RPS) is a reportable condition pursuant to 10 CFR 50.73(a)(2)(iv)(A).
At 1419, Steam Generator #1 Emergency Feedwater automatically actuated. The automatic actuation of the Emergency Feedwater System (EFW) is a reportable condition pursuant to 10 CFR 50.73(a)(2)(iv)(A).
At 1425, Steam Generator #2 Emergency Feedwater automatically actuated. The automatic actuation of the Emergency Feedwater System (EFW) is a reportable condition pursuant to 10 CFR 50.73(a)(2)(iv)(A).
At 1611, Main Feedwater restored to Steam Generator #2
At 1629, Main Feedwater restored to Steam Generator #1

C. Event Causes

Loss of Excitation:
The direct cause of loss of excitation for the Main Generator Field was determined to be a short between 2 diode modules within the rotating rectifier circuit of the Main Exciter.

Since the installment of the fully overhauled Exciter in RF18 of 2012, routine outage preventative maintenance for the Main Exciter was not implemented in line with the intent of the scope provided in ME-004-003 or the PM. This procedure includes inspection as well as the full testing, and if necessary rebuild of the Exciter. This unclear scope in the PM resulted in the PM not being fully performed.

There was no specific Preventative Maintenance Task to detect and correct deficiencies in the Exciter enclosure and interior. This resulted in the direct cause by allowing a degraded condition of the Main Exciter housing interior (water leak) and seals which allowed dirt and debris into the exciter housing, and allowed a moist atmosphere to exist. This atmosphere packed debris on the diode wheel causing tracking (shorting) between diodes.

Work Order steps were not completed (N/A'd) without providing adequate justification in accordance with EN-HU-106 section 7.1.3 guidance. This resulted in the direct cause by allowing the rotating rectifier wheel to degrade without detection or correction. Fleet administrative procedure guidance for proper use of (N/A) during a procedure usage was not followed in order to N/A the steps of the ME-004-003 procedure during refuel PMs.

NARRATIVE

Steam Generator Level Deviation:
The vendor review completed to determine the cause of the Steam Generator Level deviation did not determine the definitive cause for the deviation between the two level channels. There does not appear to be an obvious difference between the Original Steam Generators (OSG) and the Replacement Steam Generators (RSG) which would cause the two level channels measuring the level within the same SG to differ during a transient. The cause of the level channel deviations is most likely attributed to multiple factors which affect the sensed level via the pressure transmitter(s).

CORRECTIVE ACTIONS

A. Loss of Excitation:

Completed corrective actions include:

a. The Main Exciter rectifier wheel was disassembled, cleaned, repaired including replacement of failed diode modules, and reassembled.
b. Failed diodes were sent offsite for failure analysis.
c. Corrected cooling water leak and door seal degradation inside Main Exciter housing.
d. Revised Main Exciter Preventive Maintenance strategy to clearly outline the scope for Major and Minor PMs of the Main Exciter.
e. Implemented actions targeting the understanding of the proper N/A of steps in accordance with fleet administrative procedure guidance including the justification expected/required per the procedure.

B. Steam Generator Level Deviation:

Completed corrective actions include:

a. An Emergent Issue Team established during the forced outage confirmed that the Feedwater Control System performed as expected based on receiving a level deviation in both Steam Generator 1 and 2. The level deviation was not an expected plant response following a Reactor Power Cutback. Based on discussions with the replacement Steam Generator vendor, this may be an effect related to the Replacement Steam Generators
b. Completed a vendor study to determine the cause of the Steam Generator Level Deviations following the Reactor Power Cutback

Planned corrective actions include:

a. Increase SG NR level transmitter deviation check within the feedwater control system to provide sufficient operating margin to deviation setpoint
b. Calibrate the two level control transmitters such that each output is equal during steady state operation
c. Change the transmitter response time to provide additional smoothing of the level inputs to the feedwater control system and reduce the likelihood of the channel deviation check activation

SAFETY EVALUATION

The actual consequences as stated in the problem statement were low. There were no other actual consequences to safety of the general public, nuclear safety, industrial safety and radiological safety for this event. The potential consequence to safety of the general public, nuclear safety, industrial safety and radiological safety of this event, if the Automatic Reactor Trip on High Steam Generator Water Level was removed, is low. High Steam Generator Water Level in Steam Generator #2 would have also generated an automatic Reactor Trip. Failing that, the Operators would have initiated a manual Reactor Trip or taken manual control to restore Steam Generator Water Level.

Steam Generator overfill is modeled in the PRA only as it relates to success of the Emergency Feedwater A/B pump, not the Main Feedwater Pumps. The overfill modeled in these PRA sequences occurs post-trip and is based on Emergency Feedwater being established for plant conditions, therefore, this PRA assessment is qualitative in nature.

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NARRATIVE

PREVIOUS OCCURRENCES

CR-WF3-2017-5842: (Reported under LER 2017-002-00 and Supplement 2017-002-01.)
A reactor power cutback occurred on July 17, 2017 following a main turbine trip initiated from Isophase Bus Duct failure. The same level deviations occurred in Steam Generators 1 and 2. However, this event did not result in Feed Water Control shifting to manual due to the subsequent reactor trip that was experienced (failure of Fast Dead Bus Transfer).